

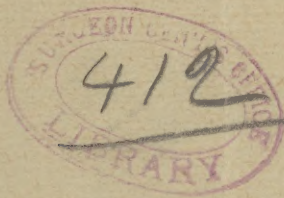
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The Influences of Climate in
the United States over
Bright's Disease.

BY
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CHICAGO.

REPRINTED FROM
The New York Medical Journal
for October 4, 1890.



*Reprinted from the New York Medical Journal
for October 4, 1890.*

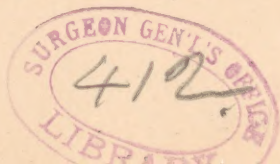
THE INFLUENCES OF
CLIMATE IN THE UNITED STATES OVER
BRIGHT'S DISEASE.

BY CHARLES W. PURDY, M. D.,

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IN attempting a systematic study of the influences exerted by climate over special forms of disease, the value of the results obtained will depend largely upon the geographical extent and variation of the territory considered. It is, furthermore, important that the lives and habits of the people comprising the whole area considered should be as nearly similar as possible, not only socially and domestically, but also as regards their surroundings and influences politically.

In all these respects the United States of America possesses the most eminent advantages. It comprises a territory three thousand miles in length by two thousand miles in width. Its area is over three millions and a half of square miles, which is twenty-nine times larger than Great Britain and Ireland, or nearly equal in extent to the whole continent of Europe. It possesses all ranges of mean temperature for the year, from 35° F. to 75° F.; all altitudes, from the sea-level to fifteen thousand feet; all



ranges of rainfall, from ten to sixty inches. The conditions of its atmosphere embrace the features of extreme dryness characteristic of far inland plains, of cool moisture from great inland lakes, and the influences of the sea varied by two oceans and numerous ocean currents. Its northeastern border is covered with snow nearly half of the year, and during the same time its southern coast is covered with vegetation of almost tropical luxuriance. It will therefore be seen that such a wide range of geographical and climatic features enables us to readily determine many questions relating to the influence of climate over disease which are difficult and even impossible to solve in those countries possessing a more limited area and climatic range.

In addition to this, the unrivaled facilities of intercommunication possessed by the United States, including the railway, press, post, and telegraph, bring the population nearer together and make the people more nearly a unit in habits and life than has hitherto been attained in any age or country of equal extent.

Unfortunately, however, with all these unsurpassed natural advantages for scientific investigation, the United States at present is placed at great disadvantage as compared with the older, and in fact with all other civilized nations, in the fact that, unlike them, it has no uniform system of registration of vital statistics. Indeed, were it not for the data afforded by the census, it would be impossible to arrive at any conclusions in the field under consideration which could be looked upon as even approximately correct. Fortunately, in the last census—that of 1880—special efforts were put forth to obtain more complete and accurate returns of deaths than had before been furnished, and likewise to make the returns more accurate as regards the causes of death.

In availing myself of the data afforded by the Tenth

Census the same course has been followed, with the view of eliminating errors, which I adopted in the study of climatic influences over other diseases.* Thus all States and Territories furnishing a total mortality of less than five thousand have been excluded from the estimates as too small to give trustworthy data.

The total number of deaths in the United States for the year 1880, as recorded by the census returns, was 756,893, and of these 5,386 were returned under the head of Bright's disease. These returns give us an average ratio of 7.11 deaths from Bright's disease in each 1,000 deaths for the whole country. In order to bring out in strong contrast the relative ratios of mortality from Bright's disease in the different States and Territories, I have constructed Table I, which gives the total mortality, the mortality from Bright's disease, and the ratio of the latter to each 1,000 deaths in each State.

A glance at Table I discloses the fact that the mortality from Bright's disease in the State of New Jersey exceeds the average for the whole country by a little over four times. New York State comes next in order, exceeding the average nearly three times. Connecticut follows, with a ratio of over double the average, while Massachusetts and New Hampshire follow, almost doubling the average for the country. Whatever be the causative influences, these five adjoining States form a strip of territory, reaching from the 39th to the 45th parallel, which is especially prolific of Bright's disease.

Before it will be possible to assume with reason that the increased fatality from Bright's disease in this region is due to special features of the climate, it must first be ascertained if the States furnishing lower death-rates from the disease

* *Treatise on Diabetes.*

than the average differ essentially in their climatic features from those just named. By again referring to Table I it will

TABLE I.

Deaths from Bright's Disease to each 1,000 Deaths, by States, in the United States for 1880.

STATES.	Total deaths.	Deaths from Bright's disease	Ratio to 1,000.
Alabama	17,929	86	4.79
Arkansas	14,812	29	1.95
California	11,530	81	7.02
Connecticut	9,179	132	14.48
Georgia	21,549	36	1.67
Illinois	45,017	213	4.73
Indiana	31,213	108	3.46
Iowa	19,377	67	3.45
Kansas	15,160	38	2.50
Kentucky	23,718	78	3.28
Louisiana	14,514	105	7.23
Maine	9,523	89	9.34
Maryland	16,919	195	11.52
Massachusetts	33,149	431	13.00
Michigan	19,743	100	5.06
Minnesota	9,037	35	3.86
Mississippi	14,583	38	2.60
Missouri	36,615	106	2.89
Nebraska	5,930	10	1.68
New Hampshire	5,584	71	12.70
New Jersey	8,474	242	28.55
New York	88,332	1,779	20.13
North Carolina	21,547	40	1.85
Ohio	42,610	256	6.00
Pennsylvania	63,881	491	7.68
South Carolina	15,728	39	2.47
Tennessee	25,919	39	1.11
Texas	24,735	53	2.14
Vermont	5,024	52	10.33
Virginia	24,681	73	2.95
West Virginia	7,418	33	4.46
Wisconsin	16,011	80	4.99

be seen that the State of Tennessee furnishes a death-rate from Bright's disease which is less by six times than the

average for the whole country—viz., 1.11. Georgia follows in order with a ratio of 1.67—about four times less than the average. Nebraska follows with about the same ratio. North Carolina and Arkansas are next in order, their ratios of mortality from the disease being less than the average by about three times and a half. The States of Tennessee, Georgia, North Carolina, and Arkansas form an adjoining tract of territory, extending from the 31st to the 37th parallel, which lies at directly the opposite point of the compass from the States which furnish the highest death-rate from Bright's disease in the country. Now, in every instance the five States furnishing the lowest ratios of mortality from Bright's disease possess distinct and similar characteristics of climate, the chief features of which are *dryness, equability, and warmth*. On the other hand, in every instance the five States furnishing the highest death-rate from Bright's disease possess distinct and similar characteristics of climate, the chief features of which are directly the opposite of those of the States furnishing the lowest death rates from the disease—viz., *moisture, coolness, and changeability*.

The variation of the death-rate from Bright's disease in each individual State named is so decided a departure from the average for the whole country—200 to 600 per cent.—that ample room is left for errors through other and minor causes, whose influence is not ignored and will be considered later.

It is well known to climatologists, however, that more accurate and trustworthy results are to be reached in estimating the influences of climate over disease by grouping together large areas of territory, including several States, in part or whole, whose chief climatic features are as near similar as possible. By taking each of these grand groups as the unit of calculations, many errors are eliminated from

the estimates that must necessarily creep into the calculations when the State is taken as the unit; and, moreover, by so doing, a more limited and purely political division of territory is substituted by a larger and purely climatic division.

In order to further facilitate the study of the climatic features of Bright's disease in the United States by grand groups,* I have constructed Table II, which gives the ratio of deaths from Bright's disease, the mean annual temperature, the annual rainfall, the elevation, and the population of each grand group.

TABLE II.

Deaths from Bright's Disease in each 1,000 Deaths in the United States for 1880, in Grand Groups, showing Climatic Features and Population of each Group.

REGION.	Ratio to 1,000.	Mean tem- perature F.	Mean rain- fall in Inches.	Elevation. in feet.	Population.
1. North Atlantic coast region.....	17.38	40-50"	40-50	100- 500	2,616,870
2. Middle Atlantic coast region.....	19.73	45-60	45-55	Below 100	4,376,135
3. South Atlantic coast region.....	2.59	60-65	50-60	" 100	875,086
4. Gulf coast region.....	9.41	70-75	55	" 100	1,056,034
5. Northeastern hills and plateaus..	11.20	35-45	35-45	500- 2,500	1,669,229
6. Central Appalachian region.....	8.23	40-45	35-40	Above 500	2,344,089
7. Northern lake region.....	7.17	45-50	30-40	200- 300	3,049,402
8. The interior plateau region.....	8.32	45-50	40-45	100- 200	5,714,683
9. The Ohio River belt.....	5.83	45-55	45-50	300- 1,000	2,440,339
10. Southern Central Appalachian re- gion.....	2.63	45-55	45-50	1,000- 2,000	2,697,958
11. Southern interior plateau.....	2.99	65-70	50-60	Below 1,000	3,625,545
12. South Mississippi river belt.....	3.14	60-65	50-55	100- 300	710,250
13. North Mississippi river belt.....	3.73	40-50	30-50	Above 500	1,990,917
14. Southwest central region.....	1.97	60-70	35-50	100- 500	2,932,676
15. Central region (plains, etc.).....	3.70	50-60	40-45	500- 1,500	4,403,662
16. Prairie region.....	3.59	50-55	25-40	Ab've 1,000	5,721,836
17. The Missouri river belt.....	2.80	40-55	20-40	500- 1,000	835,694
18. The Northwestern region.....	5.21	40-50	30-40	Ab've 1,000	1,123,419
19. Pacific coast region.....	8.72	45-65	20-60	100- 2,000	715,781
20. Region of Western Plains.....	3.92	45-65	10-20	1,500- 5,000	324,268
21. The Cordilleran region.....	3.04	50-60	10-20	4,000-10,000	931,910

Upon examination of Table II, it will be seen that Bright's disease attains its highest mortality in the Middle

* The grouping herewith adopted is that proposed by Mr. Gannett, the geographer of the Census.

Atlantic coast region—19·73 in 1,000—or considerably over two and a half times more than the average for the whole country. The North Atlantic coast region comes next in order, the ratio being 17·38 in 1,000. The northeastern hills and plateaus furnish the next highest ratio—11·20 in 1,000 deaths. The average for the three regions just named is 16·15 in 1,000—or nearly two and a half times higher than the average for the whole country. If we examine the climatic features of this tract as a whole, it must be conceded to be the coldest, the most exposed, the most changeable, as well as among the most humid in the United States. The Middle Atlantic coast region, which furnishes the highest ratio of mortality from Bright's disease (19·73) of the grand groups, is by no means the coldest region in the country, although the northern half thereof is very cold, the mean temperature range for the year being only 45° to 50° F. The climate is eminently a moist one, for, in addition to the direct influence of the sea, the surface of the country is low and sandy, and along parts of the coast—notably that of New Jersey—there are sandy reefs, shoreward from which are lagoons succeeded by extensive areas of swamp. Further inland the country is low, nowhere rising to exceed one hundred feet above the sea. In addition to this, the mean annual rainfall is high—forty-five to sixty inches. The changes of temperature are frequent, often sudden, and sometimes extreme. On the whole, however, so far as the temperature is concerned, the mean range is from 10° to 15° F. higher than in the regions of the North Atlantic coast and the northeastern hills and plateaus, where the death-rate from the disease is somewhat lower. It may therefore be properly asked, What determines the greater mortality from Bright's disease in the Middle Atlantic coast region over that in the North Atlantic coast and northeastern hills and plateaus, since the cli-

mate in the two latter regions possesses the chief features which we have thus far found prolific of the disease, to a degree at least as marked as in the Middle Atlantic coast region?

In attempting a solution of this question it should first be remembered that the Middle Atlantic coast region contains most of the larger and older cities of the country, and consequently much of the national wealth. Now, it is well known that wealth encourages a course of living that especially predisposes to Bright's disease. Indeed, no fact has become more widely recognized than that chronic Bright's disease (interstitial nephritis) is largely the outgrowth of luxurious living—the over-taxation of the kidneys in eliminating the waste products of highly nitrogenous foods. Moreover, this form of Bright's disease is uncommon before the age of forty years; indeed, it is most frequent after fifty. The Middle Atlantic coast region, containing so large a proportion of the older and wealthier population of the country, must therefore necessarily have a higher ratio of mortality from the interstitial form of Bright's disease. Besides this, nearly one half of the population of the Middle Atlantic coast region is urban, and that form of renal disease known as amyloid degeneration of the kidney (commonly returned under the head of Bright's disease on account of its accompanying dropsy and highly albuminous urine) must be more frequent there since it is so largely the outgrowth of syphilis, a disease always more frequent in large cities. Lastly, old age, scarlatina, and pneumonia are factors which stand in close causative relationship to Bright's disease as a whole, and these factors are possessed by the region in question to a degree perhaps exceeding any region in the United States. If, therefore, we consider the ætiology of Bright's disease apart from climatic influences, we find that the Middle Atlantic coast region possesses the gen-

eral elements of cause of the disease to a degree exceeding any other region of the country. Add to this the influences of climate whose leading features tend strongly toward high mortality from the disease, and the solution of the question no longer seems a difficult problem.

If now we direct attention to the North Atlantic coast region we find that the death-rate from Bright's disease is very high—17.38 in 1,000. The climate of this region is the most trying in many respects of the whole country. The mean temperature is 45° F., and the mean rainfall is about forty-five inches. This region is exposed to the damp chilling winds from the North Atlantic Ocean. In short, the climate is eminently a cold, moist, and changeable one. The general causes of Bright's disease, apart from climatic influences, are not so marked as in the Middle Atlantic coast region, and therefore the high mortality of the disease in this region is probably more purely due to the special features of climate named.

The next highest death-rate from Bright's disease is reached in the Northeastern hills and plateaus—viz., 11.20 in 1,000. Although possessing the third highest ratio of mortality from the disease of the grand groups, the ratio is considerably lower than in either of the two last grand groups considered. The climate of the Northeastern hills and plateaus is exceedingly cold, the mean range of temperature being but 40° F. This region is also an exposed one owing to its high altitude. It lacks, however, the character of humidity to the degree possessed by the two regions just considered. It is removed from the direct influence of the sea and has a mean rainfall of only about forty inches. There can be little doubt that the lessened mortality in this region from Bright's disease as compared with the two regions last considered is largely due to the comparative dryness of the atmosphere, while a high mortality, as com-

pared with the whole country, is still maintained by the cold and exposed position of this region.

If now we turn to the Southwest central region, we find the rate of death from Bright's disease to be the lowest of all the grand groups in the country—viz., 1.97 in 1,000. The climate in this region is eminently a *dry, warm, and equable* one. With a mean annual temperature of from 60° to 70° F., and a mean rainfall of thirty-five to forty inches, its chief climatic features are directly opposite to those of the grand groups which furnish the highest death-rates from Bright's disease in the country.

The South Atlantic coast region furnishes the next lowest ratio of mortality from Bright's disease of the grand groups—viz., 2.59 in 1,000. The mean temperature of this region is 60° to 65° F., and the mean rainfall is fifty-five inches. The climate of this region is a warm though rather moist one. It will be remembered that the South Atlantic coast is washed by the Gulf Stream before the latter has had time to mingle to any extent with the cool waters of the Atlantic Ocean, and therefore the east winds are warm and balmy. In addition, this region is sheltered from the north and west winds by the Appalachian range of mountains, and therefore the equability of its temperature is most marked. We learn from these facts that equable warmth tends to induce a low death-rate from Bright's disease, even though the climate is a moist one, and this statement is confirmed by the fact that the Bahama Islands, which are off the South Atlantic coast region, possess a climate that is esteemed for its favorable influence over Bright's disease the world over.

The Southern Central Appalachian region furnishes the next lowest death-rate from Bright's disease of the grand groups—viz., 2.63 per 1,000. This region may be practically considered a continuation of the South Atlantic

coast region to the westward. It differs from the latter chiefly in possessing a drier atmosphere at the expense of one slightly cooler, depending upon its higher altitude and greater distance from the sea.

The three grand groups just described, if considered as a whole, form a large tract of practically inland territory of crescent shape, the curve of which corresponds with that of the north line of the Gulf coast. It is removed from the latter sufficiently far to escape the moisture of the sea, and yet it is situated sufficiently near to receive the tempering influences of its warmth and equability. On the north and east it is protected by the base of the great Appalachian range of mountains. The conditions are therefore such, on the whole, as to produce warmth, equability, and dryness of climate to a degree nowhere else attained in any tract of equal extent in the United States. We must therefore conclude that—whether we take the State, the grand group, or a group of grand groups, as the unit of calculations—that which combines the highest range of temperature with the greatest equability and dryness of the atmosphere furnishes the lowest death-rate from Bright's disease, and, *vice versa*, that which combines the lowest temperature range with the greatest degree of atmospheric moisture and changeability furnishes the highest death-rate from the disease. It is true that a few *apparent* contradictions to these rules may be found, but, upon careful consideration, most if not all of these are readily harmonized. Thus it will be observed by glancing at Table II that the Gulf and Pacific coast regions furnish death-rates from Bright's disease considerably above the average for the whole country. At first thought this might perhaps seem surprising, considering the climatic features of these regions and the further fact that it has become the fashion in the United States to send those afflicted with Bright's disease to one or the

other of these localities for curative purposes. Upon reflection, however, the fact explains itself, for many of those in practice can attest that numbers of their patients do not return, or, if they do, they leave the records of their deaths to swell the death-rates of the disease in the places under consideration.

With regard to altitude, it may be stated that statistics do not indicate that it very materially influences the death-rate from Bright's disease further than its influence over temperature is concerned. In the northeastern hills and plateaus, where the elevation above the sea averages perhaps 2,000 feet, the mortality from Bright's disease reaches the third highest ratio of the grand groups of the country. On the other hand, in the Southern Central Appalachian region, where the altitude is even higher, the mortality from the disease sinks to the third lowest of the grand groups of the country.

Again, the Middle Atlantic coast region furnishes the highest ratio of mortality from the disease of all the grand groups in the country, and this region possesses a mean altitude of less than 100 feet above the sea; while, on the other hand, in the Cordilleran region the altitude altogether exceeds that of any other grand group in the country, yet we find the death-rate from Bright's disease in this region to be only 3.04 in 1,000—considerably less than half the average for the whole country.

In view of these observations, it must be concluded that the influence of altitude over Bright's disease in general is very slight as compared with those features of climate already considered. In this connection the fact should not be overlooked that in those forms of Bright's disease which are complicated by advanced cardiac disease, notably the late stages of interstitial nephritis, high altitudes are *distinctly dangerous*. In such cases the heart failure is has-

tened by the high altitude, which in turn is very prone to bring on fatal uræmia.

A review of these investigations substantiates the following conclusions:

1. That the chief features of climate in the United States which most strongly tend to increase the death-rate from Bright's disease are cold, moisture, and changeability of temperature.

2. That the elements of climate which tend in the greatest degree to decrease the death-rate from Bright's disease are warmth, dryness, and equability.

3. That cold most markedly increases the mortality from Bright's disease when associated with moisture, a comparatively low temperature being well borne if the atmosphere is a dry one.

4. That a comparatively high degree of humidity of the atmosphere does not markedly increase the mortality from Bright's disease if accompanied by warmth and equability.

5. That the most unfavorable residence localities for patients afflicted with Bright's disease in the United States are comprised within the Atlantic coast region and Northeastern hills, which include the States of New Jersey, New York, Connecticut, Massachusetts, New Hampshire, and Vermont.

6. That the most favorable residence localities are chiefly comprised within the Southern interior, and especially include the States of Tennessee, Georgia, North Carolina, Arkansas, and Texas.

7. Finally, a practical lesson may be learned from these investigations as follows: That, since climate so decidedly influences the mortality from Bright's disease, those who are afflicted with the disease or possess strong hereditary or other tendencies thereto should wear such garments as

most directly tend to neutralize the evil influences of climate over the disease—viz., *those combining the minimum power of radiation of body heat with the highest hygroscopic properties ; and since wool possesses these qualities to a degree unapproached by any other textile, all-wool garments should be worn next the skin throughout the year.*

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